(RESEARCH ARTICLE)

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Strategies of Public Health Management in Controlling Hypertension through Sociodemographic and Lifestyle Factors: A Structural Equation Modeling (SEM) Analysis in Coastal Communities of Sawa District, North Konawe Regency

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Abstract

Background: Hypertension is one of the major public health problems worldwide, with more than 1.28 billion adults aged 30–79 years affected, particularly in low- and middle-income countries. In coastal areas, the prevalence tends to be higher due to lifestyle patterns such as high salt intake, smoking habits, and limited access to health services. In North Konawe Regency, especially in Sawa District, these characteristics are quite prominent among coastal communities. Therefore, effective public health management strategies are needed that take into account sociodemographic and lifestyle factors. This study aims to analyze the influence of sociodemographic and lifestyle factors on public health management in controlling hypertension in the coastal community of Sawa District, North Konawe Regency.

Methods: This study used a quantitative research design with a cross-sectional approach. The population consisted of 2,289 adults aged ≥18 years who had lived in Sawa for at least one year. The sample size was 96 respondents, selected through simple random sampling using Slovin's formula with a 10% margin of error. Data were analyzed using the Structural Equation Modeling (SEM) method with the Partial Least Squares (PLS) approach through SmartPLS 3. The variables analyzed included sociodemographic factors, lifestyle, public health management, and hypertension incidence.

Results: The analysis showed that sociodemographic factors had a significant positive effect on public health management (path coefficient = 0.384; $p = 0.000 < 0.05$), and lifestyle also had a significant effect (path coefficient = 0.422; $p = 0.000 < 0.05$). Indirectly, both sociodemographic and lifestyle factors influenced hypertension incidence through the mediating role of public health management ($p < 0.05$). These results indicate that better sociodemographic conditions and healthier lifestyles contribute to more effective community health management in reducing hypertension rates.

Conclusion: Sociodemographic and lifestyle factors significantly affect public health management in coastal communities, both directly and indirectly through hypertension control. Effective public health management must consider local social characteristics and behavior patterns to ensure program success. Strengthening community-based promotive and preventive efforts, improving health education, and empowering local health cadres are essential strategies to reduce the prevalence of hypertension in coastal areas.

Keywords: Public Health Management; Sociodemographic Factors; Lifestyle; Hypertension; Coastal Communities

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1. Introduction

According to the World Health Organization (WHO, 2023), approximately 1.28 billion adults aged 30–79 years suffer from hypertension, and more than two-thirds of these cases occur in low- and middle-income countries. Although hypertension can be prevented and controlled, the levels of awareness, treatment adherence, and blood pressure control remain low. Global data show that only 46% of people with hypertension are diagnosed and receive treatment, and only 21% have their blood pressure under control. This condition indicates that hypertension is not merely a medical problem but also a complex public health management issue (1)

The global prevalence of hypertension is 22% of the total world population. The highest prevalence is found in Africa (27%), and the lowest in the Americas (18%), while Southeast Asia ranks third with a prevalence rate of 25%(2)

In North Konawe Regency, the problem of hypertension has become more apparent, particularly in coastal areas. The coastal community of Tudungano Village, Sawa District, exhibits distinctive lifestyle patterns, such as the consumption of high-salt foods like salted fish, preserved seafood, and increasingly popular instant foods. According to Mulyana et al. (2022), coastal communities in Indonesia have a 1.5 times higher risk of hypertension compared to non-coastal populations due to dietary habits, fishermen's work-related stress, and limited access to healthcare facilities. Additionally, environmental factors such as exposure to extreme weather, heavy physical activity, and irregular sleep patterns further increase the risk of hypertension (3)

From a public health management perspective, hypertension control does not solely depend on curative efforts such as the administration of antihypertensive drugs but also involves promotive and preventive measures. (4) emphasized that effective hypertension control strategies should include community education, strengthening the role of families, providing equitable access to healthcare services, and ensuring local policy support. Without effective public health management, hypertension incidence will continue to rise and may increase the burden on the healthcare system, especially in resource-limited areas such as coastal regions.

One relevant analytical approach is Structural Equation Modeling (SEM). This method allows researchers to analyze both direct and indirect relationships among variables such as sociodemographic factors, lifestyle, psychosocial aspects, and healthcare access in relation to hypertension incidence. Through SEM, a comprehensive model of public health management can be developed to serve as a basis for more effective intervention strategies. According to, the application of SEM in public health research has proven effective in mapping the complex determinants of non-communicable diseases and designing evidence-based prevention models (5)

This study offers novelty by constructing a public health management model for hypertension control based on the social characteristics and behavioral patterns of coastal communities. The Partial Least Squares–Structural Equation Modeling (PLS-SEM) approach is employed to map the structural relationships among risk factors, disease history, and blood pressure management behaviors simultaneously.

Based on the description above, research on "Public Health Management Strategies in Controlling Hypertension through Sociodemographic and Lifestyle Factors: A SEM Analysis among Coastal Communities in Sawa District, North Konawe Regency" is important to conduct. This study is expected to contribute to developing a hypertension control model suited to the characteristics of coastal communities while supporting government programs aimed at reducing the prevalence of non-communicable diseases in Indonesia.

2. Method

This study employed a quantitative design with a cross-sectional approach. This approach was chosen because it allows researchers to analyze relationships between variables at a single point in time (6) The analysis was conducted using Structural Equation Modeling (SEM) to map the direct and indirect factors influencing the incidence of hypertension.

The study population consisted of 2,289 adults aged ≥18 years who had resided in Sawa District for at least one year. Using Slovin's formula with a 10% margin of error, a total sample of 96 respondents was obtained through simple random sampling.

3. Results and Discussion

3.1. Descriptive Analysis of Variables

3.1.1. Sociodemographic Factor Variable

The respondents' responses to the indicators of the Sociodemographic variable are presented in the table below:

Tabel 1 Descriptive Statistical Data of the Sociodemographic Variable

Item	Respondents' Responses										Mean	Category
	SS (5)		S (4)		N (3)		TS (2)		STS (1)			
	F	%	F	%	F	%	F	%	F	%		
X1.1.1	32	15.9	124	61.7	31	15.4	14	7,0	0	0	4.30	Strongly Agree
X1.1.2	18	29.4	124	61.7	59	29,4	0	0	0	0	4.18	Agree
X1.1.3	29	14.4	98	48.8	74	36,8	0	0	0	0	4.23	Strongly Agree
Age (X1.1)											4.10	Agree
X1.2.1	13	6.5	128	63.7	29	14,4	23	11,4	8	4,0	4.15	Agree
X1.2.2	26	12.9	90	44.8	61	30,3	24	11,9	0	0	4.13	Agree
X1.2.3	15	7.5	134	66.7	44	21,9	8	4,0	0	0	4.06	Agree
X1.2.4	32	15.9	73	36.3	63	31,3	33	16,4	0	0	4.03	Agree
Gender (X1.2)											4.19	Agree
X1.3.1	32	15,9	123	61,2	31	15,4	15	7,5	0	0	4,16	Agree
X1.3.2	18	9,0	124	61,7	59	29,4	0	0	0	0	3.62	Agree
X1.3.3	29	14,4	98	48,8	74	36,8	0	0	0	0	4,04	Agree
Occupation (X1.3)											4,08	Agree
Average Score of the Sociodemographic Variable (X1)											4.13	Agree

Source: Primary Data Processed, 2025

Based on the research findings, the Sociodemographic variable (X1) had an overall mean score of 4.13, which falls into the "*Good*" category. This indicates that the sociodemographic characteristics of the coastal community respondents are generally positive and supportive in the context of health management, particularly in efforts to prevent and control hypertension.

For the Age sub-variable (X1.1), the mean score was 4.10, also categorized as *Good*. This suggests that most respondents belong to the productive age group and have a relatively *Good* level of health awareness. The highest score was found in item X1.1.1 (4.30), reflecting a positive perception of the influence of age on healthy lifestyle behaviors.

The Gender sub-variable (X1.2) obtained a mean score of 4.19, categorized as *Good*, indicating balanced participation between men and women in maintaining their health, particularly in adopting healthy lifestyle practices. Items X1.2.1 (4.15) and X1.2.2 (4.13) emphasize that both male and female respondents share similar responsibilities in managing their health.

Meanwhile, the Occupation sub-variable (X1.3) recorded a mean score of 4.08, also within the *Good* category. This finding shows that the respondents' occupations—most of whom work in the informal sector such as fishermen or traders do not hinder them from practicing healthy living behaviors. However, item X1.3.2 (3.62) indicates that a small proportion of respondents experience work-related limitations in accessing healthcare services or undergoing regular health check-ups.

3.2. Lifestyle Variable

The respondents' responses to the indicators of the lifestyle variable among coastal communities are presented in the table below

Tabel 2 Descriptive Statistical Data of the Lifestyle Variable among Coastal Communities

Item	Respondents' Responses										Mean	Category
	SS (5)		S (4)		N (3)		TS (2)		STS (1)			
	F	%	F	%	F	%	F	%	F	%		
X2.1.1	32	15.9	135	67,2	32	15,9	2	1,0	0	0	4.30	Strongly Agree
X2.1.2	18	29.0	132	65,7	51	25,4	0	0	0	0	4.18	Agree
X2.1.3	31	15.4	110	54,7	60	29,9	0	0	0	0	4.23	Strongly Agree
Eating Patterns (X2.1)											4.19	Agree
X2.2.1	37	18.4	128	63,7	32	15.9	3	1,5	1	0,5	4.15	Agree
X2.2.2	23	11.4	132	65,7	27	13,4	15	7,5	4	2,0	3.93	Agree
X2.2.3	29	14.4	110	54,7	58	28,9	4	2,0	0	0	4.06	Agree
Salt Consumption (X2.2)											4.06	Agree
X2.3.1	38	18.9	123	61,2	35	17,4	5	2,5	0	0	4,16	Agree
X2.3.2	26	12.9	130	64,7	27	13,4	15	7,5	3	1,5	3.62	Agree
X2.3.3	32	15.9	134	66,7	32	15,9	3	1,5	0	0	3.77	Agree
Smoking (X2.3)											3,85	Agree
Average Score of the Lifestyle Variable among Coastal Communities (X2)											4.05	Agree

Source: Primary Data Processed, 2025

Based on the descriptive analysis of the Lifestyle Variable among Coastal Communities (X2), which consists of three indicators eating patterns (X2.1), salt consumption (X2.2), and smoking habits (X2.3) the overall mean score was 4.05, categorized as *Good*. This indicates that, in general, coastal communities have adopted relatively healthy lifestyles in their daily lives.

For the eating pattern indicator (X2.1), the mean score was 4.19, with the majority of respondents expressing *agree* (65–67%) and *strongly agree* (15–16%) responses to the given statements. The highest score was obtained for item X2.1.1 (4.30), followed by X2.1.3 (4.23) and X2.1.2 (4.18). These results suggest that most coastal residents maintain *Good* eating habits, including appropriate food choices and consistent meal schedules that support health.
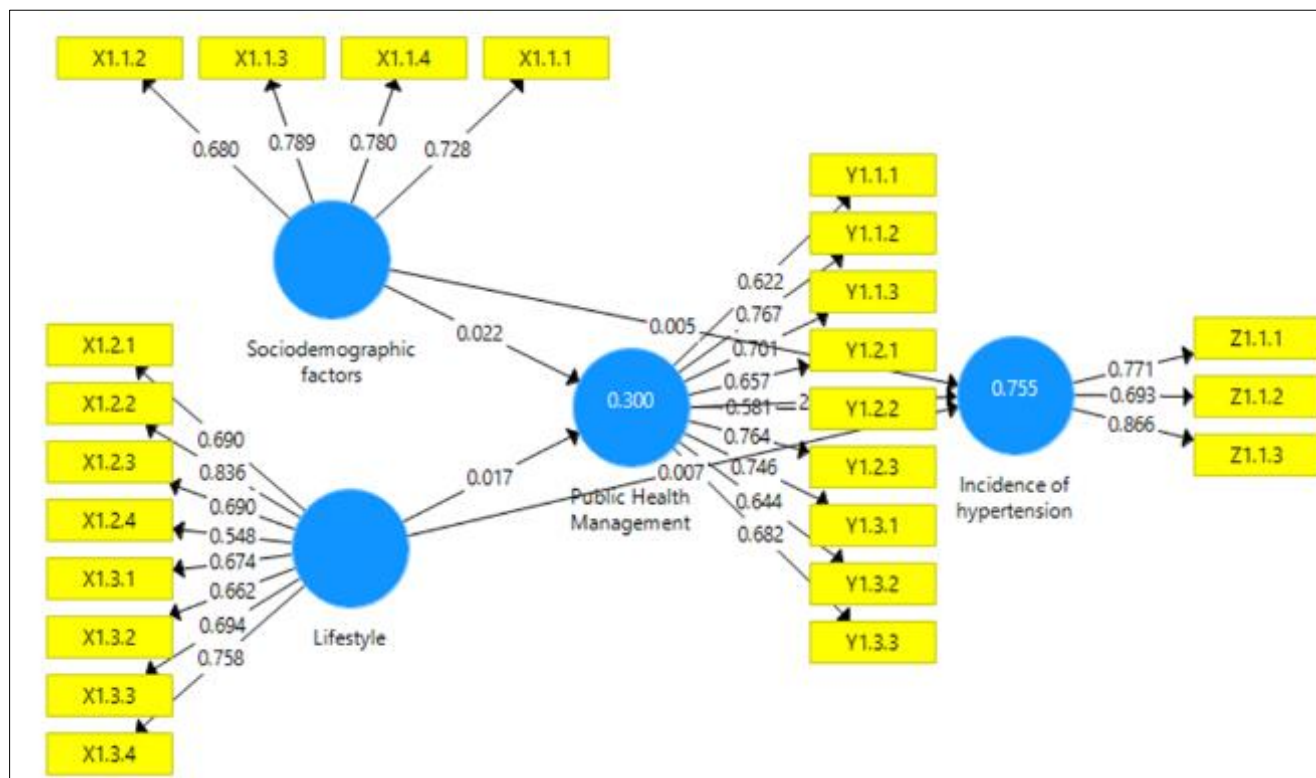
Meanwhile, the salt consumption indicator (X2.2) recorded a mean score of 4.06, also within the *Good* category. Most respondents demonstrated a relatively high level of awareness regarding the importance of limiting salt intake in their daily diet. For item X2.2.1, 63.7% of respondents agreed, yielding a score of 4.15, followed by X2.2.2 (3.93) and X2.2.3 (4.06). These findings indicate that, although coastal communities generally prefer salty flavors, they have begun to understand the adverse health effects of excessive salt consumption.

The smoking habit indicator (X2.3) obtained an average score of 3.85, which, although still categorized as *Good*, was the lowest among the three indicators. The majority of respondents (around 61–66%) agreed with statements indicating the presence of smoking habits, while a small proportion (around 2%) disagreed. Item X2.3.1 received the highest score (4.16), while the lowest score was found in X2.3.2 (3.62). These results suggest that smoking behavior remains relatively common among coastal residents, although awareness of the negative health impacts of smoking has started to increase.

4. Statistical analysis

4.1. Structural Equation Modeling Using the SmartPLS Approach

The Structural Equation Model (SEM) using the Smart Partial Least Squares (SmartPLS) approach was first subjected to testing or evaluation of the empirical research model. The results of the testing or evaluation of this empirical model are presented as follows:

Source: Primary data processed by SMARTPLS 3, 2025

Figure 1 Structural Equation Modeling Using the SmartPLS Approach

Tabel 3 Outer Loading Values of Each Indicator

Variable	Indicator	Outer Loading
Sociodemographic (X1)	Age (X1.1)	0.726
	Gende (X1.2)	0.68
	Education (X1.3)	0.781
	Occupation (X1.4)	0.718
Lifestyle (X2)	Eating Pattern (X2.1)	0.782
	Salt Consumption (X2.2)	0.753
	Smoking (X2.3)	0.74
	Physical Activity (X2.4)	0.763

Based on the results of the outer loading test in the study entitled "Public Health Management Strategy in Controlling Hypertension Using Structural Equation Modeling (SEM) in the Coastal Communities of Sawa District, North Konawe Regency," the findings show that the Sociodemographic variable (X1) consists of four indicators: age (X1.1) with a loading value of 0.726, gender (X1.2) with 0.680, education (X1.3) with 0.781, and occupation (X1.4) with 0.718. All four

indicators have outer loading values above 0.60, indicating that they are valid and able to represent the sociodemographic variable well.

The Lifestyle variable (X2) is measured through four indicators: dietary pattern (X2.1) with a loading value of 0.782, salt consumption (X2.2) with 0.753, smoking habits (X2.3) with 0.740, and physical activity (X2.4) with 0.763. All indicators show high outer loading values, suggesting that each has a strong contribution in forming the lifestyle construct.

4.2. Hypothesis Testing

4.2.1. Direct Effect Hypothesis Testing

The direct effect hypothesis testing in this study was conducted to determine the influence of the Sociodemographic (X1) and Lifestyle (X2) variables on Public Health Management (Y), as well as the direct effect of Public Health Management (Y) on Hypertension Incidence (Z). The results of the test can be seen in the following table:

Tabel 4 Results of Direct Effect Hypothesis Testing

	Original Sample	Nilai P (P values)	Description
Sociodemographic (X1) → Public Health Management (Y)	0,384	0.000	Accepted
Lifestyle (X2) → Public Health Management (Y)	0,422	0.000	Accepted

Based on the results of the relationship test between variables presented in the table above, it can be explained that all variables have p-values < 0.05, indicating that all hypotheses in this study are accepted. This means that each independent variable has a significant influence on the dependent variable in the Structural Equation Modeling (SEM) used to analyze public health management strategies in controlling hypertension in the coastal area of Sawa District, North Konawe Regency.

The test results show that the Sociodemographic variable (X1) has a significant effect on Public Health Management (Y) with an original sample value of 0.384 and a p-value of 0.000. This indicates that sociodemographic factors such as age, gender, education level, and type of occupation play an important role in determining the effectiveness of public health management programs. Communities with better sociodemographic characteristics tend to have higher awareness and participation in health-related activities.

Furthermore, the Lifestyle variable (X2) also shows a positive and significant effect on Public Health Management (Y) with an original sample value of 0.422 and a p-value of 0.000. This finding emphasizes that a healthy lifestyle such as a balanced diet, controlled salt intake, non-smoking habits, and regular physical activity greatly influences the success of public health management programs. In other words, the better the lifestyle of coastal communities, the more effectively public health management programs can be implemented to reduce the risk of hypertension.

Tabel 5 Results of Indirect Effect Hypothesis Testing

	Original Sample	Nilai P (P values)
Sociodemographic (X1) → Public Health Management (Y) → Hypertension Incidence (Z)	0,196	0,001
Lifestyle (X2) → Public Health Management (Y) → Hypertension Incidence (Z)	0,215	0.000

Based on the results of the indirect effect (mediation) analysis presented in the table above, it is evident that all variable relationship paths have p-values < 0.05, indicating that Public Health Management (Y) acts as a significant mediating variable in the relationship between Sociodemographic (X1) and Lifestyle (X2) variables on Hypertension Incidence (Z) in the coastal communities of Sawa District, North Konawe Regency.

The test results show that the indirect effect of Sociodemographic (X1) on Hypertension Incidence (Z) through Public Health Management (Y) has an original sample value of 0.196 with a p-value of 0.001. This finding indicates that sociodemographic factors such as age, gender, education, and occupation indirectly affect hypertension incidence

through the effectiveness of public health management implementation. In other words, the better the sociodemographic conditions of the community, the more effective the implementation of public health management programs will be, ultimately contributing to a lower risk of hypertension.

Furthermore, the indirect effect of Lifestyle (X2) on Hypertension Incidence (Z) through Public Health Management (Y) shows an original sample value of 0.215 and a p-value of 0.000. This result suggests that healthy lifestyle behaviors such as balanced diet, controlled salt consumption, non-smoking habits, and regular physical activity significantly contribute to reducing hypertension incidence, with public health management serving as a key mediating factor that strengthens this relationship.

Based on the data presented in Table 1.4, the conclusions of the hypothesis testing in this study are as follows

4.3. Hypothesis 1 Testing: The Effect of Sociodemographic Factors on Public Health Management

The test results show that sociodemographic factors significantly influence public health management, with a P-Value of 0.000 and a T-Statistic of 5.421. Since the P-Value < 0.05 and the T-Statistic > 1.96, this indicates that the effect is significant and positive. The Path Coefficient value of 0.215 demonstrates that the better the sociodemographic conditions of the community such as education, employment, and income the more effective public health management becomes in controlling hypertension.

4.4. Hypothesis 2 Testing: The Effect of Lifestyle on Public Health Management

The test results indicate that lifestyle has a significant effect on public health management, with a P-Value of 0.000 and a T-Statistic of 7.012. Since the P-Value < 0.05 and the T-Statistic > 1.96, the hypothesis is accepted. The Path Coefficient value of 0.362 shows that healthy lifestyle behaviors such as maintaining a balanced diet, engaging in regular physical activity, and avoiding smoking have a positive impact on enhancing the effectiveness of public health management programs.

5. Discussion

This section discusses the results of both the direct and indirect hypothesis testing among the variables Sociodemographic (X1), Lifestyle (X2), Psychosocial (X3), Public Health Management (Y), and Hypertension Incidence (Z) in the coastal area of Sawa District, North Konawe Regency.

The analysis using Partial Least Squares (PLS) revealed that all relationships among the variables had p-values < 0.05, indicating that all hypotheses proposed in this study were accepted and showed significant effects. This implies that sociodemographic factors, lifestyle behaviors, and psychosocial conditions each play important and interconnected roles in shaping the effectiveness of public health management strategies, which in turn influence the incidence of hypertension in coastal communities.

5.1. The Influence of Sociodemographic Factors on Public Health Management

The results of this study show that sociodemographic factors have a positive and significant effect on public health management in the coastal area of Sawa District, North Konawe Regency. This finding confirms that individual characteristics such as age, gender, education level, and occupation play an important role in determining the effectiveness of public health program implementation.

Theoretically, this result aligns with the perspective of Notoatmodjo , which states that sociodemographic factors are predisposing factors in the Health Promotion Model developed by Green and Kreuter. These factors form the foundation of an individual's knowledge, attitudes, and behaviors toward health (7). Age affects an individual's readiness to accept health interventions, gender determines the level of participation in promotive activities, while education and occupation influence one's ability to understand and access health services (8), (9).

This study is also consistent with several previous research findings. Siregar and Simanjuntak, found that education and occupation significantly affect community participation in non-communicable disease (NCD) control activities at *Posbindu PTM* in Medan City (10). Showed that age and education level are associated with knowledge and practice in hypertension control in rural areas (11). Emphasized that socioeconomic status and type of occupation influence access to health services and compliance in blood pressure monitoring (12). Furthermore, Asserted that education and health literacy are key determinants in the success of community-based chronic disease management programs (13).

Consistent with these findings, the World Health Organization has highlighted sociodemographic characteristics as one of the social determinants of health that play a crucial role in achieving optimal public health outcomes (14)

In the context of this study, communities with higher education levels and stable employment demonstrated greater participation in promotive health activities such as blood pressure checks, health education, and *posyandu* participation. This indicates that the higher an individual's education level and job stability, the greater their awareness of the importance of preventing non-communicable diseases such as hypertension. Conversely, groups with lower education and informal employment tend to have lower participation levels due to limited time, knowledge, and access to health information.

The implication of these findings is that public health management strategies must consider local sociodemographic conditions. Health programs should be designed based on social segmentation, using communication approaches tailored to the community's education level. Additionally, health cadres should be empowered to reach older adults and informal workers to increase participation in promotive and preventive health activities.

In conclusion, the success of public health management in controlling hypertension greatly depends on the program's ability to adapt intervention strategies to the sociodemographic characteristics of the target population.

5.2. The Influence of Lifestyle on Public Health Management

The results of this study show that lifestyle has a positive and significant effect on public health management in the coastal area of Sawa District, North Konawe Regency. The original sample value of 0.422 with a p-value of 0.000 indicates that the healthier the community's lifestyle, the more effective the implementation of public health management programs becomes. Lifestyle aspects including dietary patterns, salt consumption, smoking habits, and physical activity are crucial in shaping community health behavior, particularly in the prevention of non-communicable diseases such as hypertension.

Theoretically, this finding aligns with the Health Belief Model, which explains that healthy behavior is influenced by an individual's perception of disease risk and the perceived benefits of preventive actions (15). A healthy lifestyle adopted by the community reflects their awareness of hypertension risks and the benefits of maintaining a balanced diet, avoiding smoking, and engaging in regular physical exercise. Similarly, in the Health Promotion Model, emphasizes that lifestyle results from the interaction between knowledge, motivation, and the social environment, all of which shape health behavior. Therefore, a healthy lifestyle is not merely an individual choice but also a reflection of an effective public health management system that successfully influences community behavior (16)

This result is also supported by several previous studies. Found that high salt consumption and lack of physical activity were dominant factors contributing to hypertension in coastal communities (17). Ceported that increased community participation in exercise and nutrition education programs reduced hypertension prevalence by 12% within a year (18). Further noted that unhealthy lifestyles, such as smoking and lack of exercise, negatively affect the success of health promotion programs at the primary care level (19). Moreover, the World Health Organization, emphasized that healthy lifestyle interventions are the main pillar of the global strategy for non-communicable disease control (20).

In the context of the coastal communities of Sawa District, people with diets high in salt and fat, combined with relatively high smoking rates, pose challenges to public health management efforts. However, through continuous educational approaches, nutrition counseling, and physical activity promotion, behavioral changes toward healthier lifestyles have begun to emerge. This progress is reflected in increased community participation in group exercise, regular blood pressure monitoring, and a reduction in smoking habits across several coastal villages.

Therefore, it can be concluded that lifestyle is one of the key determinants of the success of public health management. Health programs should continue to strengthen community-based healthy lifestyle promotion strategies, such as nutrition education, anti-smoking campaigns, and the establishment of local exercise groups. A participatory and community-driven approach is believed to enhance program effectiveness in controlling hypertension and to build sustainable public health resilience within coastal communities.

6. Conclusion

Based on the results of the research and analysis using the *Structural Equation Modeling* (SEM) method with the *Partial Least Square* (PLS) approach, several main conclusions can be drawn as follows:

Sociodemographic factors have a positive and significant effect on Public Health Management.

The results indicate that sociodemographic variables, including age, gender, education, and occupation, play an important role in the effectiveness of public health program implementation. Communities with higher levels of education and more stable employment tend to have better awareness of the importance of health check-ups and hypertension prevention.

Lifestyle factors have a positive and significant effect on Public Health Management.

Lifestyle aspects such as diet, salt consumption, smoking habits, and physical activity have been proven to influence the success of public health management. Behavioral changes toward a healthy lifestyle are key components in efforts to control hypertension among coastal communities in Sawa District.

Recommendations

Based on the research findings and their implications for public health policy, several recommendations can be proposed as follows:

For the Regional Government and the Health Office of North Konawe Regency, It is necessary to strengthen community-based public health management in coastal areas by enhancing the capacity of health cadres, providing blood pressure screening facilities in every village, and expanding promotive and preventive activities at the family and community level

For Health Workers and the Sawa District Health Center

Continuous health education should be implemented focusing on lifestyle modification, such as reducing salt intake, increasing physical activity, and managing stress. Blood pressure monitoring and home visits should also be intensified as part of early detection efforts for hypertension.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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